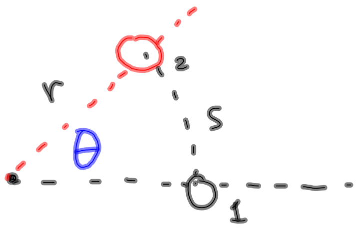
Angular position, velocity, and acceleration:

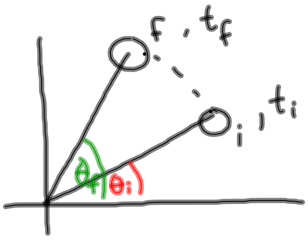


$s = r\theta$

* have to use radians for θ

$\theta(\text{rad}) = \frac{\pi}{180°}\theta(\text{deg})$

[remember the unit circle]



[units: rad]

$\Delta\theta = \theta_f - \theta_i$

* compare to Δx

$\omega = \frac{\Delta\theta}{\Delta t}$ * compare to v_{avg}

[units: $\frac{\text{rad}}{s}$]

↳ lowercase omega

$\alpha_{avg} = \frac{\Delta\omega}{\Delta t}$ * compare to a

[units: $\frac{\text{rad}}{s^2}$]

↳ lowercase alpha

SIGN CONVENTION:

- clockwise (cw) = negative
- counterclockwise (ccw) = positive

Equations for Rotational Motion:

$$\omega_f = \omega_i + \alpha t$$

$$\omega_f^2 = \omega_i^2 + 2\alpha\Delta\theta$$

$$\Delta\theta = \omega_i t + \frac{1}{2}\alpha t^2$$

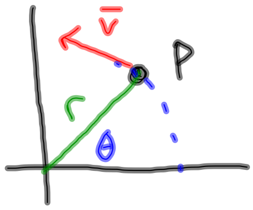
Relationship between v and ω:

$$V = r\omega$$

→ rotational velocity

→ radius

→ translational velocity (always tangent)



Relationship between a and α:

$$a = r\alpha$$

→ angular acceleration

→ radius

→ tangential acceleration

$$a_c = \frac{v^2}{r} = r\omega^2$$

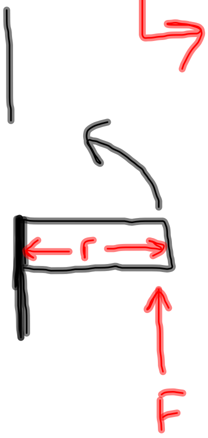
Torque:

$$\bar{\tau} = \bar{r} \times \bar{F}$$ (cross product)

$\bar{F}$ → force

$\bar{r}$ → distance from axis of rotation

τ → lowercase tau



$$\tau = rF\sin\theta$$

θ is angle bet. $\bar{r}$ and $\bar{F}$

Static Equilibrium:

- $\sum \bar{F} = 0$
- $\sum \bar{\tau} = 0$

$$\sum \bar{\tau} = \bar{\tau}_1 + \bar{\tau}_2 + \ldots$$